

SECOND EDITION.

TABLES

FOR THE

DETECTION OF SIMPLE SALTS.

held by the University of Edinburgh for Medical

Science (including Agriculture) and other Degrees;

by the Royal Colleges of Physicians and Surgeons of

W. IVISON MACADAM,

Edinburgh and the Faculty of Physicians and Surgeons

of Glasgow; FELLOW OF THE CHEMICAL SOCIETY, Veterinary

FELLOW OF THE INSTITUTE OF CHEMISTRY, &c. &c. &c.;

PROFESSOR OF CHEMISTRY, NEW VETERINARY COLLEGE, EDINBURGH;

LECTURER ON CHEMISTRY AND AGRICULTURAL CHEMISTRY,

The School of Medicine, EDINBURGH, &c.

leads to the hope that a further issue will be equally

acceptable.

April 1890.

EDINBURGH:

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1890.



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DETECTION OF SIMPLE SALTS.

W. IVISON MACADAM,

FELLOW OF THE ROYAL SOCIETY OF EDINBURGH,

FELLOW OF THE CHEMICAL SOCIETY,

LECTURER OF THE INSTITUTE OF CHEMISTRY, &c. &c.

PROFESSOR OF CHEMISTRY, NEW VETERINARY (OLDMAN, EDINBURGH),

LECTURER OF CHEMISTRY AND AGRICULTURAL CHEMISTRY,

SCHOOL OF MEDICINE, EDINBURGH, &c.

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THESE Tables are arranged to suit the Examinations held by the University of Edinburgh for Medical, Science (including Agriculture), and other Degrees; by the Royal Colleges of Physicians and Surgeons of Edinburgh and the Faculty of Physicians and Surgeons of Glasgow; by the Royal College of Veterinary Surgeons, &c. &c.

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GROUP TESTS FOR METALLIC OXIDES. GROUPS OF THE METALLIC OXIDES.

GROUP I.	GROUP II.	GROUP III.	GROUP IV. / DIVISION I.	GROUP IV. / DIVISION II.
Potassic Oxide... K_2O . Sodic Oxide... Na_2O . Ammonic Oxide... $2(NH_4)O$.	Baric Oxide... BaO . Strontic... SrO . Calcic... CaO . Magnesic... MgO .	Aluminic Oxide... Al_2O_3 . Chromous... Cr_2O_3 . Zincic... ZnO . Manganous... MnO . Nickelous... NiO . Cobaltous... CoO . Ferrous... FeO . Ferric... Fe_2O_3 .	Argentic Oxide... Ag_2O . Plumbic... PbO . Mercurous... Hg_2O .	Mercuric Oxide... HgO . Cupric... CuO . Bismuthic... Bi_2O_3 . Cadmic... CdO . Auric... Au_2O_3 . Platnic... PtO_2 . Stannous... SnO . Stannic... SnO_2 . Antimonious... Sb_2O_3 . Arsenious... As_2O_3 . Arsenic... As_2O_5 .
Test for GROUP IV, Div. II.	Test for GROUP IV, Div. 2, by Table B.	Test for GROUP III, by Table C.	Test for Table A. by Table D.	Test for Table B. by Table E.
Table E, Table A.	Table D. by Table B.	Table C. by Table C.	Table A. by Table D.	Table B. by Table E.

If a white or slightly yellow prec. is produced, it is due to sulphur precipitated by non-reducing substance.

Table A.

METALLIC OXIDES.
GROUP IV.—DIVISION I.

HCl has given a *White precipitate*.

To White precipitate obtained with HCl + Aq add $\text{NH}_4\text{HO} + \text{Aq}$.

<p><i>Pre. is soluble.</i></p> <p>$\text{K}_2\text{Cr}_2\text{O}_7 = \text{Purple-Red pre.}$</p>	<p><i>Pre. becomes darkened.</i></p> <p>$\text{SnCl}_2 = \text{Grey pre.}$ <i>Bright Cu is silvered.</i></p>	<p><i>Pre. is unchanged.</i></p> <p>$\text{H}_2\text{SO}_4 + \text{Aq} = \text{White pre.}$ $\text{KI} = \text{Yellow pre.}$</p>
<p>$\text{Ag}_2\text{O}.$</p>	<p>$\text{Hg}_2\text{O}.$</p>	<p>$\text{PbO}.$</p>

As_2O_3	Hg_2O	BiPO_4
$\text{K}_2\text{Cr}_2\text{O}_7 = \text{Pb}^{2+} + \text{Vd}^{2+} \text{ precipitates}$	$2\text{HCl} = \text{Ca}^{2+} \text{ precipitates}$	$\text{H}_2\text{SO}_4 + \text{Vd} = \text{Pb}^{2+} \text{ precipitates}$
Pb^{2+} is soluble	Pb^{2+} becomes quaternary	Pb^{2+} is insoluble

To white precipitate obtained with $\text{HCl} + \text{Vd}$ add $\text{NH}_4\text{NO}_3 + \text{Vd}$.

HCl was given a white precipitate.

GROUP IV.—Division I.

GROUP METALLIC OXIDES.

Table A.

Table B.

METALLIC OXIDES.

GROUP IV.—DIVISION II.

HCl + H₂S have given a precipitate.

Pre. is Yellow. Add $\text{NH}_4\text{HO} + \text{Aq}$ to the Pre.						Pre. is Orange-Red. Zn and H_2SO_4 = Black pre. and SbH_3 , with garlic odour.	Pre. is Brown. HgCl_2 = White or Grey pre.	Pre. is Black. Add $\text{H}_2\text{SO}_4 + \text{Aq}$.			
Soluble. AgNO_3 .			Insoluble. NaHO = White pre.					White pre. KI = Yellow pre.	No pre. Add NaHO .		
No pre. Add drop NH_4HO to same solution.	Yellow pre. CuSO_4 = Light Green pre.	Ruddy Brown pre. CuSO_4 = Blue- Green pre.	Soluble. in excess of NaHO .	Insoluble. in excess of NaHO .	White pre. H_2O in great excess = White pre.			Yellow pre. SnCl_2 = White or Grey pre. Bright Cu silvered.	Blue pre. NH_4HO BlueGreen pre soluble to Azure-blue solution. K_4FeCy_6 Ruddy pre.		
Yellow pre. $\text{CuSO}_4 + \text{NH}_4\text{HO}$ = Light Green pre.	Ruddy- Brown pre. $\text{CuSO}_4 + \text{NH}_4\text{HO}$ = Blue Green pre.										
As_2O_3	As_2O_5	(As_2O_3) H_3AsO_3	(As_2O_5) H_3AsO_4	SnO_2 .	CdO .	Sb_2O_3 .	SnO .	PbO .	Bi_2O_3 .	HgO .	CuO .
(Test for Acids.)	(Test for Acids.)	In combination as an Arsenite. Test for Group I. Oxides.	In combination as an Arsenate. Test for Group I. Oxides.								

$\text{HCl} + \text{Ag}^+ \rightarrow \text{AgCl} \downarrow + \text{H}^+$ has given a precipitate.

<p>Acids. (Test for)</p> <p>As_2O_3</p> <p>As_2O_2</p> <p>H_3AsO_3</p> <p>(As_2O_3)</p> <p>(As_2O_2)</p> <p>SnO_2</p> <p>CuO</p>	<p>Green pre. Green pre.</p> <p>= Light = Blue</p> <p>NH_4OH</p> <p>$+ CuSO_4$</p> <p>pre. Brown Ruddy.</p> <p>Yellow</p> <p>No pre.</p>	<p>Acids. (Test for)</p> <p>As_2O_3</p> <p>H_3AsO_3</p> <p>(As_2O_3)</p> <p>H_3AsO_4</p> <p>(As_2O_3)</p> <p>(As_2O_2)</p> <p>SnO_2</p> <p>CuO</p>	<p>Green pre. Green pre.</p> <p>= Light = Blue</p> <p>NH_4OH</p> <p>$+ CuSO_4$</p> <p>pre. Brown Ruddy.</p> <p>Yellow</p> <p>No pre.</p>	<p>Acids. (Test for)</p> <p>As_2O_3</p> <p>H_3AsO_3</p> <p>(As_2O_3)</p> <p>H_3AsO_4</p> <p>(As_2O_3)</p> <p>(As_2O_2)</p> <p>SnO_2</p> <p>CuO</p>	<p>Green pre. Green pre.</p> <p>= Light = Blue</p> <p>NH_4OH</p> <p>$+ CuSO_4$</p> <p>pre. Brown Ruddy.</p> <p>Yellow</p> <p>No pre.</p>	<p>Acids. (Test for)</p> <p>As_2O_3</p> <p>H_3AsO_3</p> <p>(As_2O_3)</p> <p>H_3AsO_4</p> <p>(As_2O_3)</p> <p>(As_2O_2)</p> <p>SnO_2</p> <p>CuO</p>	<p>Green pre. Green pre.</p> <p>= Light = Blue</p> <p>NH_4OH</p> <p>$+ CuSO_4$</p> <p>pre. Brown Ruddy.</p> <p>Yellow</p> <p>No pre.</p>	<p>Acids. (Test for)</p> <p>As_2O_3</p> <p>H_3AsO_3</p> <p>(As_2O_3)</p> <p>H_3AsO_4</p> <p>(As_2O_3)</p> <p>(As_2O_2)</p> <p>SnO_2</p> <p>CuO</p>	<p>Green pre. Green pre.</p> <p>= Light = Blue</p> <p>NH_4OH</p> <p>$+ CuSO_4$</p> <p>pre. Brown Ruddy.</p> <p>Yellow</p> <p>No pre.</p>
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Table C.

METALLIC OXIDES.

GROUP III.

$\text{NH}_4\text{Cl} + \text{NH}_4\text{HO} + \text{NH}_4\text{HS}$ have given a precipitate.

Pre. is NOT Black. Add NaHO to original solution.				Pre. is Black. To pre. add HCl + Aq in excess.			
White pre. Add NaHO in excess to this pre., and divide resulting solution into 2. (1) Add NH_4Cl in +.		Blue Green pre. Sol. in excess.	Flesh-coloured pre. NaHCO_3 bead is Green.	Pre. insoluble. KCy.		Pre. soluble. NaHO.	
White pre. $\text{NH}_4\text{HO} =$ White pre. Insol. in excess.	No pre. (2) Add $\text{H}_2\text{S} =$ White pre. $\text{NH}_4\text{HO} =$ White pre. Sol. in excess.			Yellow-Green pre. Sol. in +.	Brown pre. Sol. in +.	Green pre. $\text{K}_4\text{FeCy}_6 =$ Light-Blue pre.	Brown pre. $\text{K}_4\text{FeCy}_6 =$ Dark-Blue pre.
Al_2O_3 .	ZnO .	Cr_2O_3 .	MnO .	NiO .	CoO .	FeO .	Fe_2O_3 .

GROUP 1A

[illegible]

Table D.

METALLIC OXIDES. GROUP II.

$\text{Na}_2\text{HPO}_4 + \text{NH}_4\text{HO}$ have given a white precipitate.

To original solution add $\text{NH}_4\text{Cl} + \text{NH}_4\text{HO} + 2(\text{NH}_4)\text{CO}_3$.

<p><i>White pre.</i></p> <p>$\text{H}_2\text{SO}_4 + \text{Aq} = \text{White pre.}$</p> <p>which comes</p>			<p><i>No pre.</i></p> <p>$\text{H}_2\text{SO}_4 = \text{no pre.}$</p> <p>$\text{NaHO}$ or $\text{KHO} =$</p> <p><i>White pre. soluble in</i></p> <p>$\text{NH}_4\text{Cl.}$</p>
<p><i>Rapidly.</i></p> <p><i>Pre. is Pulverent.</i></p> <p>$\text{CaSO}_4 = \text{White pre. at once.}$</p> <p>$\text{K}_2\text{CrO}_4 = \text{Yellow pre.}$</p> <p>Flame is <i>Yellow-Green.</i></p>	<p><i>Pre. is Crystalline.</i></p> <p>$\text{CaSO}_4 = \text{White pre. slowly.}$</p> <p>$\text{K}_2\text{CrO}_4 = \text{slowly a Yellow pre.}$</p> <p>(Comes rapidly on boiling.)</p> <p>Flame is <i>Crimson.</i></p>	<p><i>Slowly.</i></p> <p>$\text{CaSO}_4 = \text{no pre.}$</p> <p>$\text{K}_2\text{CrO}_4 = \text{no pre.}$</p> <p>$2(\text{NH}_4)\text{C}_2\text{O}_4 = \text{White pre. insol. in } \text{HC}_2\text{H}_3\text{O}_3$</p> <p>Flame is <i>Yellow-Red.</i></p>	
<p>BaO.</p>	<p>SrO.</p>	<p>CaO.</p>	<p>MgO.</p>

R_2O^+	$\bullet 2\text{O}^+$	Cs_2O^+	MgO^+
Flame is Yellow-Green. $\text{K}^2\text{CrO}_4 = \text{Yellow precip.}$ $\text{Cs}_2\text{O}^+ = \text{White precip. at once}$ Prec. is Insoluble.	Flame is Crimson. (Copper red precip. on pouring.) $\text{K}^2\text{CrO}_4 = \text{precip. a Yellow}$ $\text{Cs}_2\text{O}^+ = \text{White precip. sparingly.}$ Prec. is Crystalline.	Flame is Yellow-Red. Prec. insol. in HCl , H_2O_2 . $2(\text{NH})_2\text{C}_2\text{O}_4 = \text{White}$ $\text{K}^2\text{CrO}_4 = \text{no precip.}$ $\text{Cs}_2\text{O}^+ = \text{no precip.}$	NH_4Cl White precip. soluble in HNO_3 or $\text{KNO}_3 =$ $\text{H}_2\text{SO}_4 = \text{no precip.}$ No precip.
$\text{H}_2\text{SO}_4 + \text{Yd} = \text{White precip.}$ White precip.	which comes		

To original solution add $\text{NH}_4\text{Cl} + \text{NH}_4\text{NO}_3 + 2(\text{NH}_4)_2\text{CO}_3$.

$\text{Na}_2\text{HPO}_4 + \text{NH}_4\text{NO}_3$ gives given a white precipitate.

GROUP II.

METALLIC OXIDES.

Table D.

Table E.

METALLIC OXIDES.

GROUP I.

The Group tests have been negative.

To original solution add NaHO and heat.

<i>Odour of Ammonia</i> (hartshorn)	<i>No odour of Ammonia is given off.</i> Try Flame Test.		
Vapour is <i>Alkaline</i> to test papers.	<i>Violet.</i> $\text{H}_2\text{C}_4\text{H}_4\text{O}_6 =$ <i>White pre. on stirring.</i>	<i>Yellow.</i> $\text{H}_2\text{C}_4\text{H}_4\text{O}_6 =$ <i>no pre. on stirring.</i>	<i>No coloured flame, or very slightly Yellow.</i> <i>Liquid is neutral to test papers.</i> <i>No residue on evaporation.*</i> <i>(Note.—If liquid is acid to test papers, test for free acid.)</i>
$2(\text{NH}_4)\text{O}.$	$\text{K}_2\text{O}.$	$\text{Na}_2\text{O}.$	$\text{H}_2\text{O}.$

* $\text{NH}_4\text{HO} + 2(\text{NH}_4)\text{CO}_3$ leave no residue on evaporation, but the solutions are alkaline and have the odour of Ammonia.

the odour of ammonia.

* $\text{NH}_4\text{NO}_3 + 2(\text{NH}_4)_2\text{CO}_3$ leave no residue on evaporation, but the solutions are alkaline and have

Odour of Ammonia (parturition)	No odour of ammonia is given off.		
	K_2O	Na_2O	H^+O
test papers: Asbont is alkaline to	White bar. on stirring. $\text{H}^+\text{C}^+\text{H}^+\text{O}^- =$ No test.	no bar. on stirring. $\text{H}^+\text{C}^+\text{H}^+\text{O}^- =$ Yellow.	test for free acid. (Note — If liquid is acid to test papers) No residue on evaporation.* Liquid is neutral to test papers. No colouring given on

To original solution add NH_4NO_3 and heat.

The Group tests gave near negative.

GROUP I. METALLIC OXIDES.

FLAME TESTS.

VIOLET—*Potassium.*

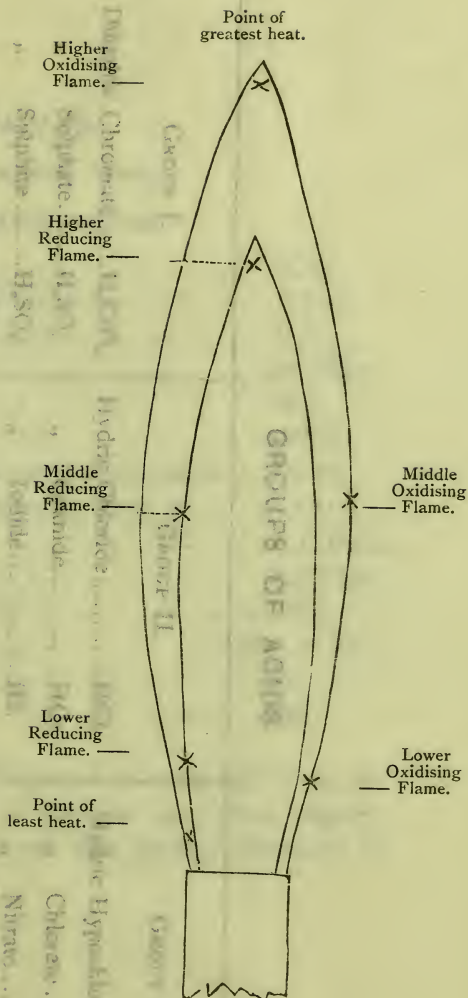
YELLOW—*Sodium.*

YELLOW-GREEN—*Barium.*

YELLOW-RED—*Calcium.*

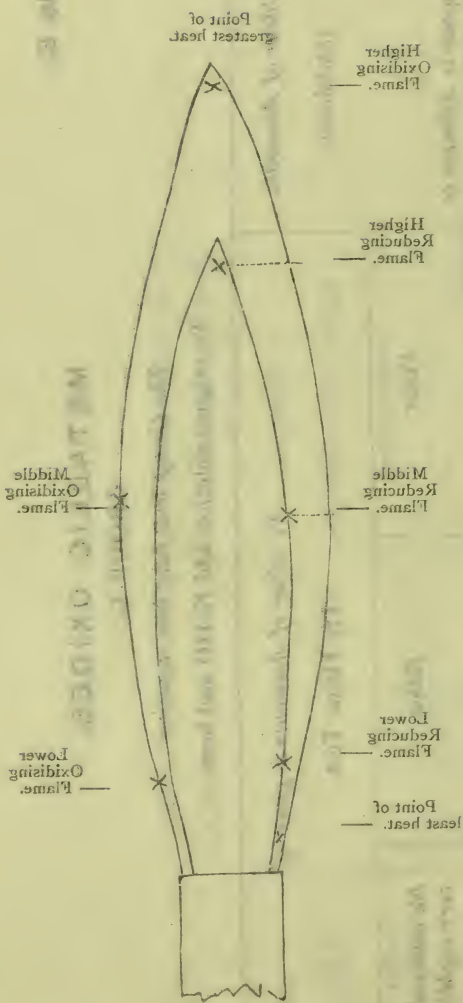
CRIMSON—*Strontium.*

GREEN—*Copper.*
Boracic Acid.



FLAME TESTS.

- VIOLET—Potassium.
- YELLOW—Sodium.
- YELLOW-GREEN—Barium.
- YELLOW-RED—Calcium.
- CRIMSON—Strontium.
- GREEN—
 - Boric Acid.
 - Copper.



GROUPS OF ACIDS.

GROUP I.		
Dihydric Chromate.....	H_2CrO_4	
" Sulphate.....	H_2SO_4	
" Sulphite	H_2SO_3	
" Thiosulphate..	$H_2S_2O_3$	
" Carbonate.....	H_2CO_3	
" Borate.....	$H_2B_2O_4$	
" Oxalate.....	$H_2C_2O_4$	
Trihydric Phosphate.....	H_3PO_4	
GROUP II.		
Hydric Chloride.....	HCl.	
" Cyanide.....	HCy.	
" Iodide.....	HI.	
" Bromide.	HBr.	
" Nitrite.....	HNO_2	
Dihydric Sulphide.....	H_2S .	
Trihydric Ferridcyanide..	H_3FeCy_6	
Tetrahydric Ferrocyanide	H_4FeCy_6	
GROUP III.		
Hydric Hypochlorite	HClO.	
" Chlorate	$HClO_3$	
" Nitrate.....	HNO_3	
" Nitrite.....	HNO_2	
" Acetate	$HC_2H_3O_2$	
" Benzoate	$HC_7H_5O_2$	
Dihydric Tartrate.....	$H_2C_4H_4O_6$	
Trihydric Citrate.....	$H_3C_6H_5O_7$	

Trihydric Phosphate..... H^3PO^4	Tetrahydric Ferrocyanide H^4FeCy^6	Trihydric Citrate..... $H^3C^6H^3O^5$
" Oxalate..... $H^2C^2O^4$	Trihydric Ferricyanide... H^3FeCy^6	Dihydric Tartrate..... $H^2C^4H^4O^6$
" Borate..... $H^3B^3O^4$	Dihydric Sulphide..... H^2S	" Benzoate..... $HC^7H^3O^2$
" Carbonate..... H^2CO^3	" Nitrite..... HNO^2	" Acetate..... $HC^2H^3O^2$
" Thio sulphate... $H^2S^2O^3$	" Bromide..... HBr	" Nitrite..... HNO^2
" Sulphite..... $H^2S^2O^3$	" Iodide..... HI	" Nitrate..... HNO^3
" Sulphate..... H^2SO^4	" Cyanide..... HCy	" Chlorate..... $HClO^3$
Dihydric Chromate..... H^2CrO^4	Hydric Chloride..... HCl	Hydric Hypochlorite $HClO$
GROUP I.	GROUP II.	GROUP III.

GROUPS OF ACIDS.

ACIDS.

PRELIMINARY TESTS.

(Add H_2SO_4 and heat.

Odour of SO_2	H_2SO_3 .
„ SO_2 and S deposited	$\text{H}_2\text{S}_2\text{O}_3$.
„ H_2S	H_2S .
„ Vinegar	$\text{HC}_2\text{H}_3\text{O}_2$.
„ Bitter Almonds	HCy .
„ Chlorine.....	HClO .
„ Chlorous Compds. and Yellow Liquid.....	HClO_3 .
Odourless or slightly Acidulous Gas given off	H_2CO_3 .
*Char and SO_2	$\text{H}_2\text{C}_4\text{H}_4\text{O}_6$.
*Char slowly and SO_2	$\text{H}_3\text{C}_6\text{H}_5\text{O}_7$.
Ruddy Gas	HNO_2 .
*Acid Fumes	HNO_3 or HCl .
Violet Vapours	HI .
Brown Vapours.....	HBr .

Note.—The H_2SO_4 is to be poured down the side of the test tube, and the thumb used to close the tube before shaking. The odour is then noted, and heat applied afterwards *if necessary*.

* Heat required.

ACIDS.

PRELIMINARY TESTS.

Add H_2SO_4 and heat.

Odour of SO_2	H_2SO_3
" SO_2 and S deposited	H_2SO_3
" H_2S	H_2S
" Vinegar	$H_2C_2H_3O_2$
" Bitter Almonds	HCl
" Chlorine.....	$HClO$
" Chlorous Compds. and Yellow Lipid.....	$HClO_2$
Odourless or slightly Acidulous Gas given off	H_2CO_3
* Char and SO_2	$H_2C_4H_4O_6$
* Char slowly and SO_2	$H_2C_6H_8O_7$
Ruddy Gas	HNO_2
* Acid Fumes	HNO_3 or HCl
Violet Vapours	HI
Brown Vapours	HBr

Note.—The H_2SO_4 is to be poured down the side of the test tube, and the thumb used to close the tube before shaking. The odour is then noted, and heat applied afterwards &

necessary.

* Heat required.

ACIDS.

GROUP TESTS.

To Neutral solution add BaCl_2 .

(If solution is Acid, first neutralise with NH_4HO and filter from any precipitate formed, then to clear filtrate add BaCl_2 .)

<i>Precipitate.</i>	<i>No precipitate.</i> Add $\text{HNO}_3 + \text{AgNO}_3$.	
Test for GROUP I. by Table F.	<i>Precipitate.</i> Test for GROUP II. by Table G.	<i>No precipitate.</i> Test for GROUP III. by Table H.

ACIDS.

GROUP TESTS.

To Neutral solution add BaCl_2 .

(If solution is Acid, first neutralise with NH_4OH and filter from any precipitate formed, then to clear filtrate add BaCl_2 .)

Add $\text{HNO}_3 + \text{AgNO}_3$		Precipitate.
No precipitate. Test for Group III. by Table H.	Precipitate.	Test for Group I. by Table F.
	Test for Group II. by Table G.	

ACIDS—GROUP I.

BaCl_2 has given a Precipitate.

White pre.

Add $\text{HCl} + \text{Aq}$ to pre., and note odour, if any.

Yellow pre.

$$\text{AgNO}_3 =$$

Purple red pre. No odour.

Soluble with effervescence

Soluble WITHOUT effervescence or odour.

Add AgNO_3 .

Odour of

liquid clear

Odour of
SO₂ and

No odour or
slightly acid.

Yellow Pre.

White pre.
HCl + Turmeric Paper
and dry.

$$\text{Zn} + \text{H}_2\text{SO}_4 = \text{H}_2\text{S}_{gas}.$$

$\text{Fe}_2\text{Cl}_6 =$
purple colour

Rose Tint.

No rose tint

$$\text{CaCl}_2 =$$

white pre.

$$\text{HC}_2\text{H}_3\text{O}_2$$
$$\text{H}_2\text{CrO}_4$$
$$\text{H}_2\text{SO}_4$$
$$\text{H}_2\text{SO}_3.$$
$$\text{H}_2\text{SO}_3$$
$$\text{H}_2\text{CO}_3$$
$$\text{H}_3\text{PO}_4$$
$$\text{H}_2\text{B}_2\text{O}_4$$
$$\text{H}_2\text{C}_2\text{O}_4^*$$

*Cyanides always contain Oxalates ; if, therefore, $\text{H}_2\text{C}_2\text{O}_4$ be found, test for HCY by Table G.

* Oxanides always contain Oxates; if therefore $\text{H}^+\text{C}^3\text{O}^4$ be found test for HCl by Table G.

$\text{H}^2\text{C}^4\text{O}^4$	H^2SO^4	H^2SO^3	H^2SO^3	H^3CO^3	H^3BO^4	H^3BO^4	$\text{H}^3\text{C}^3\text{O}^4$ *
Bubble test has. $\text{AgNO}_3 =$ Yellow has.	No colour. In water.	H^2S gas. $\text{Zn} + \text{H}^2\text{SO}^4$ forming clear SO^2 and Oxons of	bubble copious. $\text{Fe}^2\text{Cl}^6 =$ 2 has. SO^2 and Oxons of	slightly acid. No oxons or.	Yellow has.	More limy. and acid. $\text{HCl} + \text{Lime}$ has White has.	$\text{HC}^2\text{H}^3\text{O}^4$ insol. in white has. $\text{CaCl}^2 =$ No rose tint
		or with oxoni. Soluble with effluence			Vapour AgNO_3 . Soluble without effluence or oxons.		
		Vapour $\text{HCl} + \text{Ag}$ to has ² and more oxoni, if any. White has.					

BaCl^2 was given a precipitate

Table F.

ACIDS—GROUP I.

ACIDS—GROUP III.

ACIDS—GROUP II.

HNO_3 + AgNO_3 have given a precipitate.

Black pre.	Orange red pre.	Green tint.	White or Yellow pre. $\text{FeSO}_4 + \text{Fe}_2\text{Cl}_6 + \text{NaHO} + \text{HCl}$ to acid reaction.				Chlorine odour.	
$\text{Pb}_2\text{C}_2\text{H}_3\text{O}_2 =$ black pre.	$\text{FeSO}_4 =$ blue pre.	$\text{Fe}_2\text{Cl}_6 =$ blue pre.	Blue colour or pre.	No blue colour or pre. H_2SO_4 and heat.		Gas bleaches Litmus Paper.	Co_2NO_3 black pre.	
			Red fumes.	No red fumes. $\text{MnO}_2 + \text{H}_2\text{SO}_4$.				
			KI & starch + $\text{H}_2\text{SO}_4 =$ blue colour.	Violet fumes.	Brown fumes	Colourless fumes and odour of chlorine.		
H_2S .	H_3FeCy_6 .	H_4FeCy_6 .	HCy .	HNO_2 .	HI.			HBr.
								HClO_2 *

* HClO_2 gives no pre. with HNO_3 and AgNO_3 when pure, but as chlorides are generally present, a white pre. is usually obtained.

is usually obtained.

* HClO_4 gives no precipitate with HNO_3 and AgNO_3 when pure, but as chlorides are generally present, a white precipitate is usually obtained.

H_2S	$\text{H}^+\text{FeCl}_4^-$	$\text{H}^+\text{FeCl}_4^-$	HCl	HNO_3	HI	HBr	HCl	HClO_4 *
black precipitate $\text{BPSC}^2\text{H}^3\text{O}^2 =$	yellow precipitate $\text{FeSO}^4 =$	yellow precipitate $\text{Fe}^2\text{Cl}^6 =$	orange precipitate or black precipitate Blue coloration	yellow coloration $+ \text{H}^2\text{SO}^4 =$ KI & starch Red fumes	White fumes Brown fumes	White fumes Brown fumes	of chlorine and oxygen fumes Colorless	black precipitate CoSO_4NO_3
Black precipitate	Orange red precipitate	Green tint	$\text{FeSO}^4 + \text{Fe}^2\text{Cl}^6 + \text{N}^2\text{HNO} + \text{HCl}$ to acid reaction White or yellow precipitate		H^2SO^4 and heat No yellow coloration or precipitate			black precipitate Gas bubbles yellow coloration Chlorine

$\text{HNO}_3 + \text{AgNO}_3$ were given a precipitate.

ACIDS—GROUP II.

Table G.

Table H.

ACIDS—GROUP III.

No Group Test has been obtained.

Add H_2SO_4 , mix well and heat.

No acid fumes. Fe_2Cl_6		No residue.	
Evaporate to dryness.	No pre.	Heat, residue chars.	Liquid is neutral to test papers.
Residue.	Odour of burned sugar.	Acid odour.	No residue.
Heat, residue chars.	No pre.	Evaporate to dryness.	Liquid is neutral to test papers.

HNO_3	HClO_3	H_2ClO_3	$\text{HC}_2\text{H}_3\text{O}_2$	HNO_3	$\text{HC}_7\text{H}_5\text{O}_2$	$\text{H}_2\text{C}_4\text{H}_4\text{O}_6$	$\text{H}_3\text{C}_6\text{H}_5\text{O}_7$	H_2O
<i>Ruddy coloured fumes.</i>	<i>Odour of Chlorine.</i>	<i>Yellow gas with Chlorous odour.</i>	<i>Odour of Vinegar.</i>	<i>Acid Fumes.</i>	<i>Buff pre.</i>	<i>No acid fumes.</i>	<i>No pre.</i>	
KI & starch and H_2SO_4 = <i>blue colour.</i>	Gas bleaches Linum Co_2NO_3 = <i>black pre.</i>	Sulphindyllic Acid + H_2SO_4 = <i>decoloration.</i>	Fe_2Cl_6 = <i>red colour.</i>	$\text{Cu} + \text{H}_2\text{SO}_4$ = <i>red gas.</i>				
			$\text{C}_2\text{H}_6\text{O} + \text{H}_2\text{SO}_4$ = <i>odour of wine.</i>	Sulphindyllic Acid + H_2SO_4 = <i>decoloration.</i>				

HNO_3	HClO_4	H^2ClO_3	$\text{HC}^2\text{H}^3\text{O}^3$	HNO_2	$\text{HC}^2\text{H}^2\text{O}^2$	$\text{H}^3\text{C}^4\text{H}^4\text{O}^4$	$\text{H}^3\text{C}^6\text{H}^5\text{O}^5$	HO^1
fewer colours Kndq	black bar. $\text{Co}_2\text{H}^2\text{O}^2 =$ litmus gas pleches	decoloration + H^2SO^4 Acid Sulphuric aqum. Cytosine with Kellon gas	same. aqum. of $\text{H}^2\text{SO}^4 =$ $\text{C}^2\text{H}^2\text{O}^2 +$ veg colour. $\text{Fe}^2\text{Cl}^2 =$ litmus; Oqum. of	decoloration + $\text{H}^2\text{SO}^4 =$ Acid Sulphuric = veg bar. $\text{Cu} + \text{H}^2\text{SO}^4$ Acid fewer.	Heat residue opus. Residue Exhaust to glass. No bar.	Heat residue opus. Residue Exhaust to glass. No bar.	Heat residue opus. Residue Exhaust to glass. No bar.	Heat residue opus. Residue Exhaust to glass. No bar.

Adq H^2SO^4 mix well and heat.

No Qumf Test has been obtained.

ACIDS—GROUP III.

TABLE OF THE SOLUBILITY OF THE MORE COMMON SALTS.

	Ag ₂ O.	PbO.	Hg ₂ O.	HgO.	CuO.	Bi ₂ O ₃ .	CdO.	SnO.	SnO ₂ .	Au ₂ O ₃ .	PtO ₂ .	Sb ₂ O ₃ .	As ₂ O ₃ .	As ₂ O ₅ .	Al ₂ O ₃ .	Cr ₂ O ₃ .	ZnO.	MnO.	NiO.	CoO.	FeO.	Fe ₂ O ₃ .	BaO.	SrO.	CaO.	MgO.	K ₂ O.	Na ₂ O.	2(NH ₄)O.		
Oxide	A	A	A	A	A	A	A	A	a	A	A	A	W	W	A	A	A	A	A	A	A	A	A	w	w	w	A	W	W		Oxide
H ₂ CrO ₄		O																										W	W	W	H ₂ CrO ₄
H ₂ SO ₄		a	W	W	W										W	W	W	W	W	W	W	W	O	O	w	W	W	W	W	W	H ₂ SO ₄
H ₂ SO ₃																										A		W	W		H ₂ SO ₃
H ₂ S ₂ O ₃																										A			W		H ₂ S ₂ O ₃
H ₂ CO ₃	A	A			A												A	A			A		A	A	A	A	A	W	W	W	H ₂ CO ₃
H ₂ B ₂ O ₄																										A			W		H ₂ B ₂ O ₄
H ₂ C ₂ O ₄																										A		W	W	W	H ₂ C ₂ O ₄
H ₃ PO ₄	A	A			A																	A	A	A	A	A	A	W	W	W	H ₃ PO ₄
HCl	O	w	O	W	W	W	W	W	W	W	W	W	W		W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	HCl
HCy	A			A																								W	W		HCy
HI		w					W															W						W	W	W	HI
HBr										W																		W	W	W	HBr
H ₂ S	A	A		A	A	A	A	A				A	A	A			A	A				A		A	A	A		W	W	W	H ₂ S
H ₃ FeCy ₆																												W			H ₃ FeCy ₆
H ₄ FeCy ₆																												W	W	W	H ₄ FeCy ₆
HClO																										W	W	W	W		HClO
HClO ₃																								W		W		W	W		HClO ₃
HNO ₃	W	W	W	W	W	W	W										W				W	W	W	W	W	W	W	W	W	W	HNO ₃
HNO ₂																												W	W		HNO ₂
HC ₂ H ₃ O ₂		W			W										W		W					W	W			W		W	W	W	HC ₂ H ₃ O ₂
HC ₇ H ₅ O ₂																												W	W	W	HC ₇ H ₅ O ₂
H ₂ C ₄ H ₄ O ₆												W														A		w	W	w	H ₂ C ₄ H ₄ O ₆
H ₃ C ₆ H ₅ O ₇																												W	W		H ₃ C ₆ H ₅ O ₇
H ₃ AsO ₃					A																							W	W		H ₃ AsO ₃
H ₃ AsO ₄					A																							W	W		H ₃ AsO ₄

Soluble in water, W. Soluble in HCl or HNO₃, A. Slightly soluble in water, w. Slightly soluble in acids, a. Insoluble in water, HCl or HNO₃, O.

[illegible]

Soluble in water, IV. Soluble in HCl or HNO₃.

